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BUILDING COMMISSIONING

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CASE STUDY

SOUTH PUGET SOUND COMMUNITY COLLEGE — COMMISSIONING ADDS VALUE TO NEW BUILDING



Student Union Building

Construction of a new Student Union Building was completed at South Puget Sound Community College in 2000. The facility is a 29,000 square foot addition to the Food Service Building on the Olympia campus.

After construction began, the community college—in conjunction with the Washington State Department of General Administration's building commissioning program—hired Keithly Welsh Associates to commission the building.

The commissioning project took a whole-building approach, covering the mechanical and electrical systems along with several architectural systems—masonry, roofing, doors and windows.

COMMISSIONING QUICK FACTS

Building Name	South Puget Sound Community College (SPSCC) Student Union Building
Location	Olympia, Washington
Project	Commissioning of new construction
Commissioning Scope	Heating, ventilating, and air conditioning (HVAC) system and controls, fire sprinkler and alarm systems, lighting controls, electrical systems, masonry, roofing, doors, openers, hardware
Size of Commissioned Area	29,000 square feet
Total Commissioning Cost	\$45,000
Commissioning Cost per Square Foot	\$1.55 (including architectural, mechanical, fire sprinkler/alarm, and electrical systems)
First-Year Cost Benefit	\$5,400
Annual Energy Savings	\$4,100 per year

PROJECT PARTNERS

**Washington State
Department of General
Administration**
Roger Wigfield

**South Puget Sound
Community College**
Nancy Johns, Harold Suter

**Keithly Welsh Associates,
Inc.**
(Commissioning Agent)
Bryan Welsh

Hargis Engineers
Joseph Schley

Johnson Controls
(Control contractor support)
Jon Carlson

"I found the HVAC commissioning...very helpful and informative. [A subsequently-constructed building] did not have commissioning...My experience between the two has shown me that commissioning is a better route from a maintenance point of view."

Jim Karch, HVAC-R Lead
SPSCC

PROJECT SCOPE OF WORK

Because the decision to commission the building was made late in the process, final construction documents only referred to mechanical system commissioning. However, the commissioning actually took a whole-building approach, examining:

- Roofs, gutters, downspouts and overflows
- Doors including automatic sliding doors, door hardware
- Aluminum and storefront windows
- Masonry
- Two boilers
- Two heating water pumps
- Domestic water heater and domestic water pump
- Fluid cooler (cooling tower)
- Four exhaust fans
- 24 hydronic heat pumps
- Direct Digital Control (DDC) system
- Plumbing
- Fire alarm system and fire sprinkler dry system
- Lighting controls
- Electrical distribution panels and sub-panels

ISSUES IDENTIFIED

Of 190 issues identified during commissioning, the majority involved the mechanical control system, but there were also significant roof and door issues. Among the significant issues were:

- The single-ply roof over the eyebrow had ponding water, and installed grooves did not work.
- The gutter and downspout system was prone to plugging.
- Automatic sliding doors did not have safety reverse during the opening cycle. Door opening/closing operation did not meet guidelines of the Americans with Disabilities Act.
- The DDC system was prone to losing programming features, causing the system to revert to a 10% outside air minimum.
- The boiler panel did not go into alarm mode when one boiler shut down due to low gas pressure, and the other boiler did not start.
- Many thermostats did not respond to push-button override.
- There were no doors in ductwork for accessing fire/smoke dampers.
- The fire sprinkler dry system compressor had an air leak.
- Over-current devices on 8 heat pumps were oversized (code violation).
- The 3-way valve to the fluid cooler was the wrong type and was installed backwards, resulting in no cooling capacity for the system.

Since the official scope of the project only addressed mechanical systems, contractor cooperation became difficult in some cases. Thus, commissioning of the architectural elements—masonry, roofing, doors, and windows—had mixed results.

ENERGY IMPLICATIONS OF COMMISSIONING

Several problems that would have led to excessive energy consumption were identified during commissioning, including:

- Exterior doors had large air gaps and no weather-stripping or caulking around them.
- Aluminum storefront doors had no caulking along the bottom edge.
- Energy-saving door gaps on automatic sliding doors were not set correctly.
- Windows leaked water into the building. Besides being energy inefficient, this could have caused mold growth in the walls.
- Heat pumps leaked noticeably at the discharge ductwork connection.
- Air duct insulation was incomplete and/or falling off.
- Heat pump dampers were not fully closing when units were in unoccupied mode. One was 80% open. Another was 100% open while the return air damper was fully closed.
- An outside air damper was found to be completely closed when controls were indicating that it was partially open.
- Occupancy sensors were taking much longer than programmed—up to 30 minutes—to initiate unoccupied modes.
- kW demand was not displaying on the controls screen.
- Thermostats were out of calibration.
- Carbon dioxide sensors were out of calibration.
- Heat pumps were not using economizer cooling when the outside air temperature was in the 40s.
- Water heater piping was not insulated.

ADDITIONAL BENEFITS

Approximately 150 of the 190 issues identified through the commissioning process were resolved. The commissioning agent documented the remaining issues, which will help the owner get them resolved in the future.

Commissioning ensured proper operation of the HVAC-related mechanical systems, and the commissioning agent provided maintenance staff with a document to aid them in trouble-shooting future problems. Commissioning also ensured proper operation of lighting controls and provided the owner with a more completely functioning building.

Finally, the commissioning agent provided some of the only continuity in personnel on this project, as the contractor's management staff had a complete turn-over during the course of construction.

PROJECT BENEFITS

- \$5,400 in first-year cost benefits (such as problems corrected during construction and testing of systems)
- \$4,100 in annual energy savings
- More than 150 of 190 issues identified during commissioning were resolved
- Written document for maintenance staff that identifies O&M issues to monitor and that provides testing and troubleshooting procedures
- A more completely functioning building than would otherwise have resulted



Student Union Building fluid cooler (cooling tower)

FOR INFORMATION ON WASHINGTON'S COMMISSIONING PROGRAM



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WHAT IS COMMISSIONING?

Building commissioning is a systematic and documented process of ensuring that building systems perform according to the design intent and the owner's operational needs.

Commissioning is used in both new construction and existing buildings.

Commissioning:

- Provides a better environment for occupants
- Reduces indoor air quality problems
- Reduces occupant complaints
- Reduces contractor call-backs and warranty issues
- Reduces energy consumption and operational costs

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